

5 What is claimed is:

1. A device for scaling a source image to a destination image, comprising:

an interpolation filter, wherein the interpolation filter is to upscale the source image to an intermediate image, wherein the intermediate image has a size equal to a size of the destination
10 image adjusted by a scale factor; and

a first average filter to downscale the intermediate image to the destination image.

2. The device of claim 1, wherein the first average filter further is to average horizontally
15 the intermediate image on a two-by-two pixel basis.

3. The device of claim 1, wherein the first average filter further comprises a plurality of cascaded average filters, wherein the number of the plurality of cascaded average filters is based on the scale factor.

20 4. The device of claim 1, further comprising:

a second average filter to average vertically the intermediate image on a two-by-two pixel basis.

25 5. A method of downscaling a source plurality of pixels to a destination plurality of pixels, comprising.

upsampling the source plurality of pixels to an intermediate plurality of pixels, wherein the

intermediate plurality of pixels has a size equal to a size of the destination plurality of pixels adjusted by a scale factor; and

downscaling the intermediate plurality of pixels to the destination plurality of pixels.

5 6. The method of claim 5 wherein the scale factor is a power of two and the size of the intermediate plurality of pixels is equal to a destination height multiplied by a destination width multiplied by the scale factor.

7. The method of claim 6, wherein the scale factor is based on the destination height.

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8. The method of claim 6, wherein the scale factor is based on the destination width.

9. The method of claim 6, wherein the scale factor is based on the destination height and the destination width.

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10. A graphics card, comprising:
interpolation logic to upscale a source image to an intermediate image, wherein the intermediate image has a size equal to a size of a destination image adjusted by a scale factor; and

20 average logic to downscale the intermediate image to the destination image.

11. The graphics card of claim 10, further comprising
a buffer comprising storage with a size of half of the destination image size plus half of a length of a preceding line in the intermediate image; and

25 a vertical average filter communicatively coupled to the line buffer, wherein the vertical

average filter is to average vertically the intermediate image on a two-by-two pixel basis.

12. The graphics card of claim 10, wherein the average logic further averages horizontally the intermediate image on a two-by-two pixel basis.

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13. The graphics card of claim 10, wherein the scale factor is based on a height of the destination image.

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14. The graphics card of claim 10, wherein the scale factor is based on a width of the destination image.

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18. The display device of claim 15, wherein the scale factor is based on a destination width.

5 19. The display device of claim 15, wherein the average filter further averages horizontally the intermediate plurality of pixels on a two-by-two pixel basis.

20. A computer, comprising:

a processor; and

10 a storage device, comprising instructions, wherein the instructions when executed by the processor comprise:

 upsampling a source plurality of pixels to an intermediate plurality of pixels, wherein the intermediate plurality of pixels has a size equal to a size of a destination plurality of pixels adjusted by a scale factor; and

15 downsampling the intermediate plurality of pixels to the destination plurality of pixels.

 21. The computer of claim 20, wherein the scale factor is a power of two and the size of the intermediate plurality of pixels is equal to a destination height multiplied by a destination width multiplied by the scale factor.

20 22. The computer of claim 20, wherein the scale factor is based on a destination height.

 23. The computer of claim 20, wherein the scale factor is based on a destination width.

25 24. The computer of claim 20, wherein the scale factor is based on a destination height

and a destination width.

5

25. A computer, comprising:

a storage device to store a source bitmap; and

a display device comprising

an interpolation filter to upscale a source plurality of pixels to an intermediate plurality of pixels, wherein the intermediate plurality of pixels has a size equal to a size of a destination plurality of pixels adjusted by a scale factor, and

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a
first
average
filter
to
downscale
the
intermediate
plurality
of
pixels
to
the
destination
bitmap.

a first average filter to downscale the intermediate plurality of pixels to the destination bitmap.

15
The
computer
of
claim
25,
wherein
the
first
average
filter
is
to
average
the
intermediate
plurality
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pixels
by
adding
color
components
of
adjacent
pixels
in
a
same
row
and
performing
a
right
shift
operation
on
the
result,
for
every
two
pixels
in
the
intermediate
plurality
of
pixels.

26. The computer of claim 25, wherein the first average filter is to average the intermediate plurality of pixels by adding color components of adjacent pixels in a same row and performing a right shift operation on the result, for every two pixels in the intermediate plurality of pixels.

20

27. The computer of claim 25, wherein the scale factor is based on a destination height.

28. The computer of claim 25, wherein the scale factor is based on a destination width.

29. The computer of claim 25, wherein the first average logic further averages horizontally the intermediate plurality of pixels on a two-by-two pixel basis.

25

5 30. A program product comprising a signal-bearing media bearing instructions, wherein the instructions when read and executed by a processor comprise:

 upsampling a source plurality of pixels to an intermediate plurality of pixels, wherein the intermediate plurality of pixels has a size equal to a size of a destination plurality of pixels adjusted by a scale factor; and

10 downscaling the intermediate plurality of pixels to the destination plurality of pixels.

31. The program product of claim 30, wherein the scale factor is based on a destination height.

15 32. The program product of claim 30, wherein the scale factor is based on a destination width.

33. The program product of claim 30, wherein the scale factor is based on a destination height and a destination width.

20 34. The program product device of claim 30, wherein the downscaling further averages the intermediate plurality of pixels on a two-by-two pixel basis.

35. A graphics card, comprising:

25 downscaling logic to:

perform bilinear interpolation on a plurality of samples from a source bitmap to produce an intermediate bitmap, and

downscale the intermediate bitmap to produce a destination bitmap by averaging every two adjacent values in a row of the intermediate bitmap.

5

36. The graphics card of claim 35, wherein the intermediate bitmap has a size equal to a size of the destination bitmap adjusted by a scale factor.

10

37. The graphics card of claim 35, wherein downscaling the intermediate bitmap further comprises:

averaging vertically the intermediate bitmap on a two-by-two pixel basis.

15

38. The graphics card of claim 35, wherein the downscaling further is to average every second line of the intermediate bitmap with a corresponding pixel in a previous line.

39. The graphics card of claim 36, wherein the scale factor is based on a size of the destination bitmap.

20

40. An apparatus for downscaling, comprising:
an interpolation filter to upscale a source bitmap to an intermediate bitmap; and
a first average filter to horizontally downscale the intermediate bitmap to a destination bitmap, wherein the first average filter comprises:

storage to store a pixel,

shifter logic to shift color components of the intermediate bitmap, and

25

adder logic to add the color components of the intermediate bitmap.

41. The apparatus of claim 40, further comprising:
a line buffer to store output from the first average filter; and
a second average filter to vertically downscale the intermediate bitmap to the destination
5 bitmap.

42. The apparatus of claim 40, wherein the intermediate bitmap has a size equal to a size
of the destination bitmap adjusted by a scale factor.

10 43. The apparatus of claim 41, wherein the line buffer comprises storage with a size of
half of the destination bitmap plus half of a length of a preceding line in the intermediate bitmap.

15 44. The apparatus of claim 42, wherein the scale factor is based on a height of the
destination bitmap.

20 45. An apparatus for downscaling, comprising:
an interpolation filter to upscale a source bitmap to an intermediate bitmap, wherein the
intermediate bitmap has a size equal to a size of the destination bitmap adjusted by first and
second scale factors; and

25 a plurality of first cascaded average filters to horizontally downscale the intermediate
bitmap to a destination bitmap, wherein the first scale factor determines the number of the
plurality of first cascaded average filters.

46. The apparatus of claim 45, wherein the plurality of first average filters each comprise:
storage for storing a pixel from the intermediate bitmap,

shifter logic to shift color components of the intermediate bitmap, and
adder logic to add the color components of the intermediate bitmap.

47. The apparatus of claim 45, further comprising a plurality of second cascaded filters to
5 vertically downscale the intermediate bitmap to the destination bitmap, wherein the second scale
factor determines the number of the plurality of second cascaded average filters.

48. The apparatus of claim 45, wherein the first and second scale factors are different.

10 49. A computer, comprising:
a processor;
memory coupled to the processor, wherein the memory comprises a graphics application
that is to generate a source bitmap; and
a display device coupled to the processor and the memory, wherein the display device
15 comprises:

a bilinear filter, wherein the bilinear filter is to upscale the source bitmap to an
intermediate bitmap, wherein the intermediate bitmap has a size equal to a size of a
destination bitmap adjusted by a scale factor,

20 a plurality of cascaded horizontal average filters to average horizontally the
intermediate image on a two-by-two pixel basis,

a line buffer to store output from the plurality of cascaded horizontal average
filters,

a plurality of cascaded vertical average filters to average vertically the
intermediate image on a two-by-two pixel basis, and

25 a selector to deliver an output of the plurality of cascaded horizontal average
filters to both the line buffer and the plurality of cascaded vertical average filters.

50. A device, comprising:

an interpolation filter, wherein the interpolation filter is to upscale a source bitmap to an intermediate bitmap, wherein the intermediate bitmap has a size equal to a size of a destination
5 bitmap adjusted by a scale factor; and

an averaging filter to downscale the intermediate bitmap to the destination bitmap,
wherein the averaging filter comprises:

storage for storing a pixel from the intermediate bitmap,

shifter logic to shift color components of the intermediate bitmap, and

10 adder logic to add the color components of the intermediate bitmap.

51. A computer, comprising:

a storage device to store a source bitmap; and

a graphics card comprising

an interpolation filter to upscale a source plurality of pixels to an intermediate
15 plurality of pixels, wherein the intermediate plurality of pixels has a size equal to a size of
a destination plurality of pixels adjusted by a scale factor, and

a first average filter to downscale the intermediate plurality of pixels to the
destination bitmap.

20 52. The computer of claim 51, wherein the first average filter is to average the
intermediate plurality of pixels by adding color components of adjacent pixels in a same row and
performing a right shift operation on the result, for every two pixels in the intermediate plurality
of pixels.

25 53. The computer of claim 51, wherein the scale factor is based on a destination height.

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	